



SECTION 1026

REINFORCED CONCRETE CULVERT PIPE

1026.1 Scope. This specification covers reinforced concrete pipe to be used for the conveyance of sewage, industrial wastes and storm water, and for the construction of culverts.

1026.2 Basis of Acceptance.

1026.2.1 The basis of acceptance will be in accordance with AASHTO M 170 (M 170M), unless otherwise specified. Pipe shall be from an approved qualified plant and accepted based on certification, manufacturer quality control documentation, and tests on samples as required by the engineer.

1026.2.2 The contractor for quality control purposes and the engineer for quality assurance purposes may select and apply the basis of acceptance in accordance with either Section 5.1.1 or 5.1.2 in AASHTO M 170 (M 170M).

1026.2.2.1 If cylinders are tested, the cylinders shall be tested in accordance with AASHTO T 22. The average compressive strength of all cylinders tested shall be equal to or greater than the design concrete strength.

1026.2.2.2 If cores are cut from the wall of the pipe and tested, the cores shall be cut and tested in accordance with AASHTO T 280. If the compressive strength of each core tested is equal to or greater than the design concrete strength, the compressive strength of the concrete for the lot will be considered acceptable.

1026.2.2.2.1 If the compressive strength of a core tested is less than the design concrete strength, two additional cores shall be taken from that pipe section and tested. Concrete represented by these core tests will be considered acceptable if the average of the two additional cores is equal to or greater than the specified strength, and no single core is less than 85 percent of the specified strength.

1026.2.2.2.2 If the compressive strength of the three cores is not in accordance with [Sec 1026.2.2.2.1](#), the pipe section from which the core was taken will be rejected. Two pipe sections from the remainder of the lot shall be selected at random and tested for conformance with either [Sec 1026.2.2.2](#) or [1026.2.2.2.1](#). If both pipe sections meet the core strength requirements of either [Sec 1026.2.2.2](#) or [1026.2.2.2.1](#), the concrete compressive strength of the remainder of the lot will be accepted. If the compressive strength of either of the two pipe sections tested does not meet the requirements, the remainder of the lot will be either rejected or, at the option of the manufacturer, each pipe section of the remaining lot shall be cored and will be accepted individually. Any pipe sections that have a core not meeting the requirements of either [Sec 1026.2.2.2](#) or [1026.2.2.2.1](#) will be rejected.

1026.2.2.2.3 If the cores cut from a section of pipe meet the strength test requirements, the core holes shall be plugged and sealed by the manufacturer in a manner such that the pipe section will meet all requirements of these specifications. Pipe sections so sealed will be considered satisfactory for use.

1026.3 Material. Reinforced concrete pipe shall be in accordance with AASHTO M 170 (M 170M), except as specified otherwise herein.

1026.3.1 Reinforced Concrete. Reinforced concrete shall consist of a mixture of cement, mineral aggregate and water, in which steel has been embedded in such a manner that the steel and the concrete act together.

1026.3.2 Cement. Cement shall be in accordance with [Sec 1019](#). Fly ash or GGBFS may be used to replace cement in accordance with [Sec 501](#), except approved Class C or Class F fly ash may be used to replace a maximum of 25 percent of Type I or II cement on an equivalent weight (mass) basis. Fly ash shall not exceed 25 percent by weight (mass) of the total cementitious material, i.e., microsilica, steel slag or other pozzolanic material.

1026.3.3 Steel Reinforcement. All steel reinforcement shall be in accordance with [Sec 1036](#).

1026.3.4 Aggregate. Fine and coarse aggregate shall be in accordance with [Sec 1005](#), except that gradation requirements and percent passing the No. 200 (75 µm) sieve will not apply.

1026.3.5 Concrete Mixture. The proportion of cementitious material in the mixture shall be no less than 470 pounds per cubic yard (280 kg/m³) of concrete.

1026.3.6 Modified or Special Designs. The manufacturer may request approval of modified designs that differ from the designs in Section 7.1, AASHTO M 170 (M 170M); or special designs for sizes and loads beyond those shown in Tables I to V of AASHTO M 170 (M 170M); or special designs for pipe sizes that do not have steel reinforcement areas shown in Tables II to V of AASHTO M 170 (M 170M). Modified or special designs shall be in accordance with AASHTO M 242.

1026.3.7 Joints. If a rubber gasket-type joint is specified, joints shall be Type A rubber gaskets in accordance with AASHTO M 198. The manufacturer shall conduct tests in accordance with AASHTO M 198, Section 8, to demonstrate adequate performance, and shall furnish certification that the physical and chemical properties of the gasket are in accordance with this specification.

1026.3.8 Curing. A curing membrane in accordance with [Sec 1055](#) may be applied, and if used, shall be left intact until the strength requirements are met.

1026.3.9 Lift Holes. If agreed upon by the engineer and the manufacturer, no more than two holes may be cast or drilled in the wall of each pipe for the purpose of handling at the construction site. The holes shall be no larger than 2 1/2 inches (63 mm) in diameter for pipe 60 inches (1500 mm) in diameter or less, and no larger than 3 1/2 inches (88 mm) for pipe greater than 60 inches (1500 mm) in diameter. Lift holes shall be carefully cast or drilled in a manner such that it will not be necessary to cut, bend or otherwise weaken the circumferential steel in the inner cage in pipe having two lines of reinforcement, or any of the circumferential steel in pipe having one line of reinforcement. Lift holes will be permitted for pipe specified with rubber gasketed joints only with written approval from the engineer.

1026.3.10 Marking. Each pipe shall be marked by the manufacturer with a “Q Cast” stamp to certify the pipe was produced by an American Concrete Pipe Association (ACPA) certified plant.

1026.3.10.1 The following additional information shall be clearly marked on the inside of each section of pipe by indenting on the pipe section or by painting thereon with waterproof paint:

- (a) Pipe class.
- (b) Date of manufacture.
- (c) Name or trade-mark of the manufacturer.

1026.3.10.2 One end of each section of pipe with elliptical reinforcement shall be clearly marked, during the process of manufacturing or immediately thereafter, on the inside and the outside of opposite walls along the minor axis of the elliptical reinforcement with the word "Top" or "Bottom" to designate the proper position when laid.

1026.4 Sampling, Testing and Acceptance Procedures. All manufacturers furnishing pipe for MoDOT projects shall be qualified as herein described. All pipe will be subject to inspection by the engineer at the source of manufacture, at an intermediate shipping terminal or at destination. The engineer shall be allowed unlimited access to all facilities and records as required to conduct inspection and sampling in accordance with [Sec 106](#).

1026.4.1 Application for Placement on Qualified List. To become qualified, a written request shall be sent by the manufacturer to Construction and Materials with the following information:

- (a) A statement certifying that the quality control procedures at the plant meet the requirements set forth by the American Concrete Pipe Association (ACPA) Compliance Audit and Certification Program.
- (b) Sources for each material to be used in the fabrication of pipe. For aggregate sources, the ledge the material is being taken from shall also be included.
- (c) A guarantee that all material to be used in the fabrication of pipe will be in accordance with MoDOT specifications, and pre-approval for any source of material will be received prior to use.
- (d) Units of measurement, English or metric, used to fabricate the pipe.

1026.4.2 Maintaining Qualification. To maintain qualification, the manufacturer shall perform and maintain a quality control program in accordance with the ACPA Compliance Audit and Certification Program, with the following modifications:

- (a) The bill of lading for each shipment of material used in the production of pipe shall be kept on file for three years.
- (b) For all aggregate, the aggregate producer shall provide a certificate of compliance to applicable MoDOT specifications and identify what ledges the aggregate is being produced from. The certificate of compliance shall be kept as long as that material from that source and ledge is being used.
- (c) A sieve analysis for determination of aggregate gradations used in each concrete mix shall be conducted once per month, and when an aggregate source is changed.
- (d) The percentage of deleterious substance for each aggregate fraction shall be determined once a month.
- (e) Admixtures shall be from approved sources and the manufacturer's certification that the material meets MoDOT specifications shall be kept on file for one year.

(f) Mill test reports for reinforcing steel shall be kept on file for one year.

(g) Once a month, an absorption test shall be conducted for each mix used in the production of pipe. Test results shall be kept on file for one year.

(h) For pipe with diameters of 66 inches (1675 mm) or larger, three edge bearing tests shall be performed once per 1000 feet (305 m) of pipe manufactured, and at least once per year. Testing will not be required at plants where pipe of these diameters is not manufactured, nor will pipe of these diameters be required to be manufactured solely for the purpose of performing this testing.

(i) The manufacturer shall notify Construction and Materials at least 24 hours prior to each shipment.

1026.4.3 Plant Certification. After October 1, 2004, plants for concrete pipe production shall be certified by ACPA, and the certification shall be maintained current.

1026.4.4 Disqualification of a Manufacturer. A manufacturer may be disqualified to provide pipe for use on MoDOT projects based on the discretion of Construction and Materials, for reasons including, but not limited to, not maintaining ACPA certification, failure of material to consistently meet specifications, falsification of any documentation, misbranding of pipe, unsatisfactory performance in the field or for other reasons indicating lack of consistent material quality.

1026.4.4.1 In a case where a manufacturer loses ACPA certification and was not disqualified for any other reason, reinstatement will be considered when the manufacturer is recertified by ACPA.

1026.4.4.2 A manufacturer will not be considered for reinstatement until after one year from the date of removal for falsification of documents.

1026.4.4.3 Three notices of failure to meet specification requirements within a 12-month period will be cause for disqualification of the manufacturer for one year, effective from the date of the third notice.

1026.4.4.4 A manufacturer disqualified within one year of the end of a disqualification may be subject to permanent removal, with no application for reinstatement accepted for a period of three years.

1026.4.5 Reinstatement of a Manufacturer. Consideration of reinstatement of a manufacturer once disqualified will be no sooner than specified in [Sec 1026.4.4](#), will require a written document from the manufacturer stating the reasons for disqualification and the action taken to correct those deficiencies, written concurrence from Construction and Materials that the problem has been suitably addressed, and followed by an application in accordance with [Sec 1026.4.1](#).

1026.4.6 Sampling of Material. Random sampling of the pipe or material used in the production of pipe will be conducted by the engineer to verify the pipe and material are in compliance with applicable specifications. Sampling size and frequency will be at the discretion of the engineer.

1026.5 MoDOT Identification Number. When the manufacturer contacts the engineer in accordance with [Sec 1026.4.2](#), the engineer will assign a specific MoDOT identification number for each size of pipe in the shipment.

1026.6 Bill of Lading. A bill of lading or delivery receipt for each shipment of pipe shall be furnished to the engineer at the shipping and destination points. The bill of lading shall contain an itemized statement of the sizes and lengths of pipe with the corresponding designated MoDOT identification number provided to the manufacturer for each size of pipe for that shipment. The bill of lading shall contain a certified statement. The certified statement shall be signed by an authorized representative of the manufacturer and shall state the following:

“This certifies that the pipe, bands and end sections in this shipment are in accordance with MoDOT specifications, were fabricated at an approved plant and were fabricated from the following brand names:”